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MANUFACTURING TECHNOLOGY SUPPORT (MATES) II

Task Order 0006: Air Force Technology and Industrial Base Research and Analysis

Subtask Order 0004: Study on Supply Chains and Social Media

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Interim Report

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14. ABSTRACT

The supply chain social media study was conducted from 28 March 2013 - 11 October 2013. The objective of this study was to: 1. More efficiently identify, evaluate, source, and qualify suppliers to better handle demand surges and supply chain disruptions (Assembly); 2. Better communication supply chain information (technical specifications, engineering change orders, product requisitions or releases, production, shipment and so on) to reduce effort and increase quality and on-time delivery (Communications); 3. Foster greater collaboration to improve production planning, more quickly identify and resolve supply chain issues and increase innovation (Collaboration); and, 4. Provide quantitative and qualitative insights into the industrial base and individual companies to facilitate better planning, improve decision-making, and provide an early warning of potential problems (Insights).

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1.0   SUMMARY

The assembly and coordination of today's manufacturing supply chains is becoming increasingly difficult, impacting the Department of Defense's (DOD) agility and responsiveness. This challenge stems largely from the growing number of participants needed to make an item and a wide disparity of software and communications tools within those supplier networks.

At the same time, businesses are increasingly turning to enterprise social network (ESN) platforms to help bridge communications gaps, provide nearly instant communications and improve the ability to connect with others. These ESN platforms incorporate functionality similar to public offerings, such as Facebook and Twitter, providing a well-known interface that can be adopted quickly. However, the solutions typically sit behind a firm's firewall so that employees and selected outside partners can communicate and collaborate within the safety of a private network.

The Air Force Research Laboratory (AFRL) recognized an opportunity to use these ESN platform solutions to overcome some of the DOD's manufacturing supply chain challenges. The objectives of this project were to:

- Identify how ESN platforms are being used in commercial supply chains;

- Identify which of those lessons apply to the DOD; and

- Determine the impact that ESN platforms might have on DOD supply chains.

In the first phase, an extensive literature review revealed that some manufacturers are using ESN platforms internally to gain efficiencies. While there were very few examples where these solutions are being used in manufacturing supply chains, there are plenty of articles, papers and web postings that discuss how they might be used. Numerous surveys that indicate the growing awareness of the value of these solutions also were found.

Primary research was conducted in the next phase, directly engaging large corporations, software manufacturers, consultants and other organizations. Those conversations largely validated the literature search findings – there is very little use of ESN platforms in manufacturing supply chains to-date.

One promising exception was Teva Pharmaceuticals, a $20 billion Canadian firm with plants in 60 countries. The firm deployed Yammer, a robust ESN solution from Microsoft. Yammer helped Teva dramatically shorten the time to raise awareness of an issue, connect the right people who could help, and facilitate collaboration to resolve the matter quickly. This effort resulted in a 40 percent reduction in manufacturing cycle time and a 60 percent improvement in supplier lead time (Gonzalez, 2011).

Due to the lack of real-world case studies, the team developed several common Air Force supply chain scenarios that could be used as representative case studies. These scenarios were provided to three ESN platform providers so that they could demonstrate how their solutions might be used to address the supply chain challenges. The onsite demonstrations proved very useful, helping make clear the value of the solutions in the DOD environment.

One unique finding was the ability of these new technologies to monitor and analyze tremendous volumes of social media data, identifying useful trends and patterns or even uncovering single nuggets of information. These tools are being used by most major consumer brands to improve

their offerings and provide better demand forecasting. Organizations like the American Red Cross use these capabilities to improve response times and increase accuracy of the types and levels of assistance delivered (Ungerleider, 2012).

The team was able to quickly identify three key areas where these new technologies could help the DOD. The first was to improve supply chain efficiency by enabling seamless collaboration throughout, regardless of disparate systems or processes. Second, these tools provide new means to monitor and avert supply chain risk by tapping into the volume and tone of conversations within the ESN platform as well as across the internet. Finally, current industrial base analysis efforts can be augmented by the ability to constantly analyze millions of social technology information streams.

There were several key conclusions from this research.

1. **Awareness of ESN platforms is growing rapidly**, with the subject becoming an increasingly frequent topic in everything from articles to conferences.

2. **The value is becoming more evident** as respected institutions provide validation, which should help drive a significant increase in adoption of these solutions.

3. **Experience is key to understanding the benefits**, providing a solid roadmap to identify how to best deploy ESN platform solutions.

To gain experience that will help accelerate results from these technologies, the team is recommending two pilot projects. By monitoring and measuring a well-defined experiment, the potential value of these solutions can be better understood and quantified. That, in turn, would help the Air Force accelerate adoption of these solutions to benefit its own supply chains.

One pilot would be focused on more quickly resolving supply chain production problems. These challenges are unexpected, often have significant time pressures and typically involve high volumes of direct human interaction. Based on the findings, it is believed that the use of an ESN platform solution could help dramatically accelerate problem resolution and thereby increase production efficiency.

The other pilot would be designed to improve visibility into the industrial base. Leveraging social technologies can provide immediate industrial base insights around the clock. Potential insights could range from identifying a lower-tier supplier that may be having production issues to uncovering a potential raw material shortage.

Each of these pilots would take about one year to complete. While running them in parallel could accelerate the results, the team will need to assess whether doing so would diminish the results. The outcome of these pilots will be a clear roadmap of how the Air Force can quantify ESN platform benefits and set the stage for adoption of these solutions throughout the DOD.

2.0   INTRODUCTION

Through a variety of programs, including Connecting American Manufacturing, the DOD has identified ongoing needs for the efficient assembly and coordination of manufacturing supply chains. Some of those include a need to:

- Increase the accessible network of manufacturers;

- More easily find the right manufacturers at the right time; and

- More readily connect to, and communicate with, those manufacturers.

The Air Force Research Laboratory (AFRL) team has recognized the rapid growth of social media for business purposes and considers the technology to be a potentially powerful means to address many of these challenges. The AF Manufacturing Technology (ManTech) organization has a lengthy history of exploring and adapting leading edge business models to improve the affordability of manufactured weapon systems. Their Next Generation Agile Manufacturing strategic vision (Boden, 2010) places heavy emphasis on the importance of a responsive and integrated supply chain, but also recognizes that tomorrow's industrial base needs to be extensively interconnected as a precondition to other advanced capabilities. This Social Media Supply Chain Study was launched in April 2013 to explore how leveraging new networking paradigms and communications tools might help solve some of the challenges highlighted by that vision of future DOD manufacturing.

The first objective of this study was to identify how social media is being used today to help organizations better assemble and coordinate manufacturing supply chains. The second was to identify which of those lessons apply to the DOD, and what new or innovative social media uses could help DOD supply chains. Finally, the third objective was to determine how social media might provide better insights into the industrial base and the performance of DOD supply chains.

In addition to staff of the AFRL, other participants in this project include Christopher Peters with The Lucrum Group and Mark Schaefer of Schaefer Marketing Solutions. Mr. Peters has done extensive work in manufacturing supply chains, with an emphasis on their assembly and coordination. Mr. Schaefer has 27 years of industry experience and is a best-selling author, teacher and speaker on the topic of social media. Both gentlemen have done considerable work in driving adoption of new technologies.

The emphasis for this work was not on public social media technologies, such as Facebook or Twitter. Rather, this effort was focused on enterprise technologies that may be similar, but were designed for use within or across business organizations. These enterprise technologies provide features that are more tailored to the complex needs of an organization. Such features range from advanced analytics to the ability to protect privacy at multiple levels.

3.0 METHODS, ASSUMPTIONS, AND PROCEDURES

The project team comprised the following individuals.

- Air Force Research Laboratory
    - Brench Boden, Lead, Advanced Enterprise Concepts
    - Andrea Helbach, Materials Engineer
- Universal Technologies Corporation (Prime contractor)
    - Angie Haas, Program Manager
- The Lucrum Group (Sub-contractor)
    - Christopher Peters, CEO
- Schaefer Marketing Solutions (Sub-contractor)
    - Mark Schaefer, Executive Director

After finalizing the project objectives, the first major task was a literature search. The team was most interested in case studies that would provide a benchmark of commercial organizations using social media platforms to help overcome supply chain communications and coordination challenges. The search effort was accomplished with general online search tools, such as Google and Springer Link, a search tool for academic works.

The team next conducted primary research by direct interview of more than twenty individuals from large corporations, software manufacturers, consultancies and other organizations. These interviews consisted of open-ended questions focused on discovering how companies are using social media in their supply chains.

To compensate for the lack of viable case studies, the team developed demonstration scenarios aligned with common DOD supply chain challenges. Those scenarios were then provided to several social media platform providers who demonstrated how their solutions could address those supply chain challenges.

The combination of results from the literature and primary search efforts and the scenario demonstrations provided the foundation for the team's findings.

4.0 RESULTS AND DISCUSSION

4.1 Social Media - Definitions, Trends, and Applications

4.1.1 The Social Media Revolution

Social media is a revolution in personal communication technology and is now the preferred method of connection, conversation and collaboration for millions of people worldwide – and the number one use of the Internet by far. The amount of content viewed and exchanged on Facebook, for example, makes it the largest media entity in history. Figure 1 illustrates this unprecedented rate of technology adoption.

The fact that these platforms are so popular, so widely adopted and so easy to use provides an exceptional opportunity for business. These technologies can be very powerful when applied to business settings where connection, communication and collaboration are historically poor. The traditional hurdle of technology adoption would be very low.
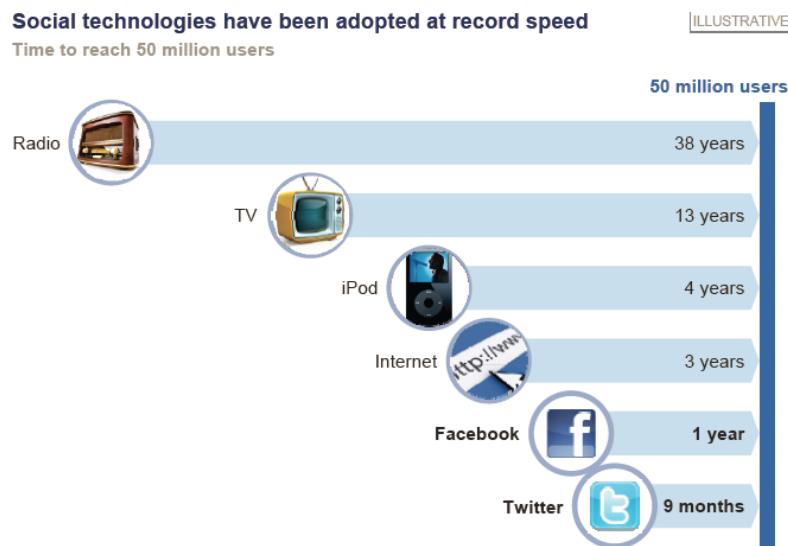
Figure 1. Technology Adoption Cycles

But this trend also presents a problem. In an age of information overload, where everyone is a publisher, it becomes increasingly difficult to hold a person's attention. With so many content distractions, the key is being able to discern the signal from the noise.

Big data analytics provide the opportunity to monitor sentiment and opinions expressed on all of this published content to find the signal. Nearly every large brand is tapping into this information goldmine for early warning signals of consumer discontent and marketing opportunity.

Toyota, Nike, Tyco and Shell are just a few of the many companies that are widely applying social technologies to their internal business processes. However, the technologies they are using internally are not the publicly available and familiar sites like Facebook and Twitter. These ESN tools are similar yet powerful enterprise platforms that can reside behind secure firewalls. This way, employees and selected outside partners can fully utilize social discovery and collaboration tools within the safety of a private network.

A common feature among the various ESN platforms is the ability to publish and share information in almost any format, and then seamlessly communicate or collaborate around that content. One aspect that separates this technology from traditional approaches, like email or shared network folders, is that the information – including any discussions or collaboration – is accessible from one common tool. That information can now be retained, accessed and used by anyone around the world, provided they have the right permissions.

Another feature is the ability to provide details about, and connectivity to, the people in a network, as well as related networks. For instance, if there were a network centered on the F-35, an engineer at Pratt & Whitney could easily connect to and collaborate with their counterpart at Lockheed Martin. What makes this feature even more powerful is that advanced functionality and algorithms help improve the precision of matching the best people to an interest or need.

One obvious use of the ability to more quickly find the right information or people is to resolve problems or issues. That may mean finding someone on a team with answers, or it could be a fellow engineer at an unrelated company who has faced similar challenges. Another benefit often cited is the increased ability to innovate through improved communications tools and better connectivity.

ESN platforms are rapidly gaining acceptance at large companies because of the obvious opportunities to lower costs and expose problem-solving opportunities to a private, global network. Yammer, a Microsoft company and one of the leaders in this field, said in an interview with Mr. Schaefer that an estimated 65 percent of the Fortune 500 companies are at some stage of implementing an internal social-based network. A McKinsey study forecasts that this is by far the biggest cost-benefit opportunity for social technologies and claims that perhaps a trillion dollars in possible savings are available (Chui, et al., 2012). Most of these savings come from unlocking data and improving knowledge worker productivity by 20-25 percent.

4.1.2 Application of ESNs to DOD Needs

Enterprise social networks will help people connect and collaborate around the world in ways that were not possible before. Problems will be exposed before they become drags on the system. Ad hoc teams will organize around problems in real-time instead of through organizational charts. The right information will be presented at the time that it is needed, saving countless hours of searching. Finally, all of this data, ranging from conversations and collaborations to documents and drawings, will be captured in one place and can be leveraged for future use.

There are three major areas where ESN platforms could specifically benefit DOD supply chains:

1. **Collaboration.**

   The ability to seamlessly collaborate across supply chains, regardless of disparate systems or processes, can impact many areas. For instance, ESN platforms could instantly connect the right engineers, buyers, program managers, manufacturers and Warfighters to collaboratively resolve a design issue or correct a production problem. Network connectivity and discovery can introduce new people or ideas, thereby improving innovation. By enhancing the quality of partner interactions – through speed, accessibility and accuracy – organizations could significantly improve supply chain effectiveness.

2. **Supply chain risk monitoring.**

   By tapping into the real-time volume and tone of conversations in the social network and across the web, organizations could identify emerging risks to the supply chain. A common scenario might be discovering a potentially disruptive strike or protest that is being organized online and acting proactively to enable alternative suppliers. This feature can provide an early warning of potential disruptions before they have an impact on operations.

3. **Industrial base analysis.**

   The ability of social monitoring to constantly analyze millions of information streams presents new tools to help evaluate and monitor industrial base health and availability at all tiers. The sheer breadth of information presents the opportunity to leverage individual data points, as well as aggregate data that can identify issues that might otherwise be missed. Because news travels so fast over social media, the insights gleaned can be much timelier. This combined breadth and speed of insights can help the DOD improve industrial base analysis by augmenting data collected from related efforts, like the sector-by-sector, tier-by-tier analysis (S2T2) (Office of the Deputy Assistant Secretary of Defense for Manufacturing and Industrial Base Policy, 2012).

4.1.3   Government Agency Adoption

Although the research established that social technologies are not yet widespread in the area of the supply chain, these technologies are used in many areas of business besides marketing. More importantly, several government agencies are leading the way in the use of these solutions.

The U.S. intelligence community was one of the first, launching its program A-Space in 2008. This program couples access to unclassified and classified interagency databases with connectivity between analysts throughout the agencies – whether they were already known or not. The result is "…a means of sharing information that, in the normal course of events, might not be seen at all" (Wikipedia contributors, 2013).

In 2009, the Defense Advanced Research Projects Agency (DARPA) ran a competition to learn how social networking might improve communications and coordination. This challenge was designed to discover how social media networks might accelerate discovery of valid data while weeding out false data. The Massachusetts Institute of Technology won the competition, leveraging a combination of social media and incentives to solve the challenge much faster than DARPA expected (Wikipedia contributors, 2013).

Multiple agencies within the DOD have implemented limited ESN capabilities primarily aimed at internal coordination, knowledge sharing, and information dissemination. Examples include: the Defense Technical Information Center DODTechipedia - a wiki-like service designed to facilitate connections between the DOD technical community and the needs of the warfighter; the Army's milSuite, which started as a knowledge management capability but is now expanding to provide online field manuals; and Aristotle, which facilitates communication at the project and technology research level for the Air Force Research Laboratory.

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4.2   Secondary (Literature) Research Highlights

4.2.1   Growth of Social Supply Chain Discussions

The earliest study that explored the idea of social media use in a supply chain was published in the Spring 2006 edition of the MIT Sloan Management Review. The author, Andrew P. McAfee wrote "Enterprise 2.0: The Dawn of Emergent Collaboration." The first mention of social supply chain found was posted by Adrian Gonzalez on August 10, 2011.

Since then, the topic has taken off. There are five LinkedIn groups that deal with the topic of social media and supply chains, and the subject has been a popular topic at professional conferences. There are numerous studies and new solutions in the works.

CFO magazine, though typically focused on financial matters, published an article titled "Social Media and the Coming Supply-Chain Revolution" in 2012. Major studies on the topic were released, such as McKinsey Global Institute's The social economy: Unlocking value and productivity through social technologies. Several software companies, including Volerro and Kenandy, launched solutions aimed at facilitating the social supply chain.

Despite the growing level of discussion about social supply chains, there are only two solid case studies that were found in the secondary research phase. These examples have been around for several years and have found their way into most of the literature on the subject. The first case study is Home Depot, which used the technology to support its store network by facilitating internal communication and knowledge transfer of innovative ideas and best practices (Gonzalez, 2012).

The best case study came from Mr. Tony Martins and his work at Teva Pharmaceuticals, where he was able to reduce manufacturing cycle time by 40 percent and improve upstream supplier lead time by as much as 60 percent (Gonzalez, Want a fast response supply chain? Focus on Facilitating people-to-people communications, 2011). (See APPENDIX for more information.)

Aside from those two case studies and despite numerous articles and blogs, there was very little of substance when it came to applying social technologies to supply chains.

4.2.2   The Lack of Adoption To-Date

Awareness of the need for seamless supply chain communication and coordination at all tiers has been growing quickly, particularly since the tsunami in Japan and floods in Thailand wreaked havoc for so many companies. On a parallel path, there is growing interest in the opportunity to use social technologies for supply chain communications and coordination. However, there has been very little adoption of this solution, which would seem to be a natural fit.
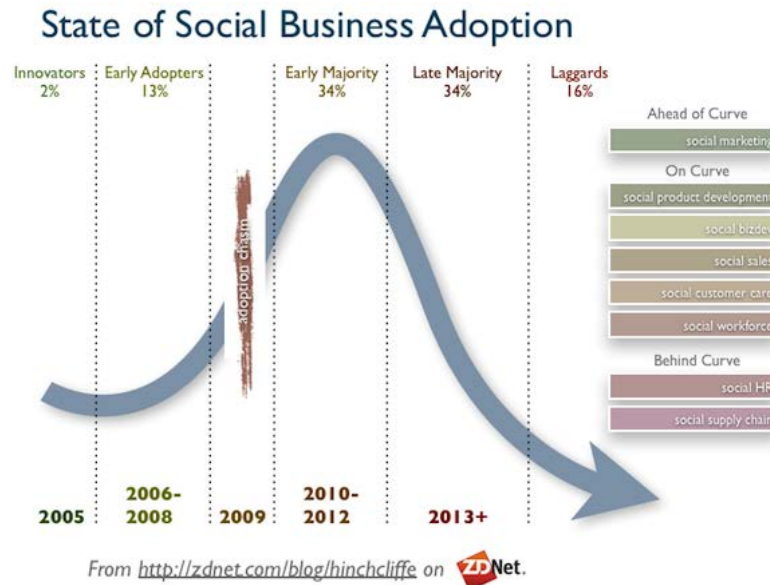
Figure 2. State of Social Business Adoption

ZDNet published an article in November 2012 that looked at the state of social business adoption. The author, Dion Hinchcliffe, benchmarked the data on social media adoption by the public versus by business and determined that "…businesses were about 2-4 years behind the rest of the world" (Hinchcliffe, 2012). Worse yet was that the social supply chain was furthest behind in adoption. (See Figure 2.)

This raised the question of why social supply chain adoption is lagging when it seems such a powerful solution. Mr. Schaefer and Mr. Peters developed several theories, which also were echoed in a blog posting titled "The Lagging Adoption of Social Media in Supply Chain Management" (Murray, 2013).

1. **Social media confusion**

    For many, social media means tools like Facebook and Twitter, which are open, public and free. Most people are not aware that there are social technologies designed for business use that are private, more sophisticated and often expensive. For that reason, Mr. Schaefer had suggested using the term enterprise social network to help introduce the business-centric concepts.

2. **Uncertainty of sharing**

    There is a natural human avoidance to exposing information that could have repercussions, whether it is a company behind in production or individuals asking a question about something they feel they should know. While public social media exposes all information indiscriminately, ESNs provide much greater control over what information is shared and with whom. This feature helps address many legal concerns, such as the protection of intellectual property.

3. **Unclear business value**

   Probably the greatest reason for lack of adoption within supply chain circles is the lack of a clear return on investment. Couple this with the confusion over social media, and most executives raise an eyebrow when the issue is broached. That is about to change.

The team also believes the lack of case studies is a reason for the slow adoption. In the e-commerce arena, it took case studies from Dell, Whole Foods, Zappos, Weirton Steel and others to illustrate what was possible and to ignite activities from companies seeking to replicate those successes. There are too few case studies in the area of social supply chains that are being created and discussed.

4.2.3 Building the Foundation for Adoption

There are several elements coming together that indicate the adoption of enterprise social network platforms is about to grow considerably.

The first is the growing use of social technologies by all business people, including senior executives and board members. A recent Stanford study showed that 80 percent of board of directors and senior executives (average age in the mid-50s) from industries that include manufacturing, utilities and retail have a LinkedIn account (Larcker, Larcker, & Tayan, 2012). Nearly 70 percent also have Facebook accounts, and 46 percent have Twitter accounts.

While this does not mean that senior management has jumped in with both feet, it does indicate that this group has a growing awareness of the value of the technology. That will make it easier for executives to understand and evaluate opportunities to deploy enterprise social network solutions.

Another element is the ever-growing need to improve supply chain communications and coordination. While solutions like electronic data interchange (EDI) effectively handle structured transactional data, there is a growing emphasis on all of the unstructured information that flows between trading partners. (Unstructured information is defined as "information that either does not have a pre-defined data model or is not organized in a pre-defined manner" (Wikipedia contributors, 2013). A recent Stanford study found that more than half of all communications between trading partners takes place by phone, email and fax – typical conveyances of unstructured information (Gillai & Yu, 2013).

These forms of communications typically create silos of information that are not easily captured or leveraged. Whether that information is related to sourcing, scheduling or even design changes, those conversations must be captured and made available to the right team members at the right time. ESN solutions do just that, facilitating instant communications across all supply chain tiers regardless of disparate systems.

The final element that is falling into place is the recognized value of these solutions. ESN solutions are being adopted rapidly for internal company use. Once a competency is acquired there, it makes sense that companies would begin to experiment with external applications. While there are few good supply chain case studies, there are plenty of examples where individual organizations are realizing benefits.

Industrial Mold & Machine in Ohio gained a 20 percent increase in production and a 40 percent reduction in labor costs by deploying social technology on the shop floor. The company

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accomplished this by outfitting computer tablets with a social application and making them available on the production floor. While it was the younger workers who first made use of the tablets, most of the rest of the workforce soon followed. On top of the production and labor benefits, the company was able to provide immediate answers to customer questions, which directly impacted customer satisfaction (Pledger, 2013).

Saint-Gobain, a €40 billion global manufacturer in the construction industry, achieved results with a common social collaboration platform that included faster time to market. According to Jive Software, maker of the social platform being used, "Saint-Gobain has experienced multiple instances where they've saved man-months of work, found new opportunities for existing products and significantly improved product designs through collaboration amongst people who never knew each other before" (Jive, 2013).

As stories like these raise awareness of the value of social technologies within single organizations, more and more companies are looking to apply those solutions to the supply chain. In fact, a survey in 2012 by Aberdeen Group found that 35 percent of the best-in-class performers are "…currently leveraging supplier B2B social efforts to improve intelligence and supply chain operations" (Aberdeen Group, 2012).

One of the most comprehensive studies found by the team was done by McKinsey Global Institute in July 2012. The study discovered that, on average, information workers spend 28 hours a week on emails searching for information and collaborating internally. The McKinsey team projected that advanced manufacturing industries (semi-conductors, automotive and aerospace & defense) deploying social technologies across the value chain could see a total value increase of between 2 and 7 percent (as a percentage of revenue) (Chui, et al., 2012).

As quantitative evidence of the value of ESNs mounts, the rate of adoption can be expected to climb quickly. A survey by Adelante SCM has already indicated that more than 80 percent of supply chain executives believe social media will have at least a positive impact on supply chain processes – at best it will transform them (Gonzalez, The Social Side of Supply Chain Management, 2013).

4.3 Primary (Original) Research Highlights

Research into the existing literature and known applications led the team to believe that there was vast opportunity to apply social technologies to the supply chain, but the team witnessed little or no real activity, let alone valid case studies.

In addition to seeking evidence in the literature, the team also conducted primary, original research by directly contacting leaders at several large companies known for their supply chain innovations, including Proctor & Gamble, GE Aviation, McDonalds, Wal-Mart, and Intel. The contacts had nothing to report regarding use of social platform applications in their supply chains. The director of social media for one of the country's largest companies said, "We are probably behind in this area but are following it." This was a typical response.

Nearly a dozen social media thought leaders, authors, and consultants were contacted to look for any sign of activity. Again, the team was unable to discover any significant applications that could be documented for this report. Following are some of those experts contacted, with several key customers indicated:

- Jay Baer (Wal-Mart, FedEx);

- Mitch Joel (Many national brands in Canada); and

- Jason Falls (Jack Daniels, Yum! Brands).

Finally, the preliminary conclusion of inactivity was verified with one of the leading experts in this field, Dr. Michael Chui, a principal at McKinsey and one of the authors of the seminal report *The social economy: Unlocking value and productivity through social technologies.*

In addition to writing this important report, Dr. Chui has been active at conferences and speaking on this topic. He confirmed in his interview by Mr. Schaefer that he has yet to see any real progress in the supply chain area. Dr. Chui said in the interview that "Almost any human interaction that can be conducted electronically can be made social, but only 5 percent of all potential uses now take place through social networks."

4.3.1 Overcoming Obstacles with Scenarios

Our research showed conclusively that there are very few existing cases where social technologies are leveraged in manufacturing supply chains. Based on the research, the team concluded that there were several likely reasons to explain this situation.

1. There is a dearth of public case studies, which are often a key factor in driving adoption of new technologies (Rogers, Diffusion of Innovations, 2003).

2. Other than marketing departments, most departments in manufacturing organizations, such as operations, procurement and logistics, have little or no experience with enterprise social platforms.

3. While implementation within a single organization is challenging enough, driving adoption across a supply chain of multiple companies with disparate processes and priorities is even more challenging.

4. The constant exposure of public social media's approach of sharing all information with everyone will continue to raise concerns about privacy within industry until there is enough awareness of, and trust in, the ability for enterprise social network platforms to provide complete control over privacy.

These challenges are an ideal fit for the ManTech role, and the project team concurred that there was enough evidence of opportunity and potential to move ahead with further investigations. Adrian Gonzalez, one of the thought leaders in this field, summed it up well when he said: "We know social media will transform supply chain processes. We just don't know how exactly, or where to start" (Gonzalez, The Social Side of Supply Chain Management, 2013)

The next logical step was to find a way to demonstrate the practical application of these technologies in the absence of empirical evidence. The team decided to create its own preliminary case studies through the development of written scenarios aligned with typical Air Force supply chain problem areas. The following six scenarios in three potential use categories were developed, (See APPENDIX for details.) depicting common challenges where an enterprise social network platform could be applied:

Collaboration and coordination

- Quickly resolve a production problem.

- Improve engineering change order collaboration.

- Crowd-source a new product.

- Handle a surge in demand.

Supply chain risk monitoring

- Identify a potential raw material shortage.

Industrial base analysis

- Improve lack of lower tier visibility.

For each scenario, relevant supply chain metrics were identified using the Supply Chain Operations Reference (SCOR®) model. These metrics can serve as a pragmatic and consistent means of evaluating various solutions applied to the scenarios.

4.3.2 Enterprise Social Network Platform Providers

A key element of the primary research was to identify and gather information about the various providers of ESN platforms. All of these platforms are very similar, by design. By offering features very close to the user experience on public platforms, such as Facebook and Twitter, collaborators immediately enter a familiar interface, reducing adoption hurdles and training costs. Common features include:

- A Facebook-like news feed with the ability to comment;

- Profiles of individuals and organizations;

- An ability to organize into private or public groups;

- Tools that help users quickly find the most relevant information and connect to the most helpful people or groups;

- Multiple means of communicating publicly or privately with one or many individuals using text, voice or video;

- The ability to search instantly across all documents, discussions and profiles; and

- Document creation, collaboration, management and file sharing.

The team interviewed a number of social media experts and reviewed analyst reports to get a consensus on the leading ESN platforms. This is a very crowded space, so the expert advice saved considerable effort. The following seven companies, in alphabetical order (with any parent company shown), make most analysts' lists:

- Chatter (Salesforce.com);

- Jive;

- Lithium;

- Socialcast (VMWare);

- SocialText;

- Tibbr (Tibco); and

- Yammer (Microsoft).

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The team also learned directly from IBM that it has been aggressively acquiring companies to provide a comprehensive ESN solution branded as Connections. Although IBM has not yet been promoting this capability and has not been included in many industry reports, the company was included in this evaluation.

After vetting these software companies, the team determined that as of the date of this report, Jive and IBM offered the following distinctive advantages that would be key to any DOD implementation:

1. They could be implemented behind a DOD firewall, an important security feature.

2. They had both recently acquired social media monitoring companies that could help address supply chain risk and industrial visibility challenges.

3. Both companies are developing capabilities to proactively connect people and information rather than the traditional means of someone having to search for information or resources. This provides enhanced opportunities for problem solving and innovation.

4. Both Jive and IBM have considerable experience with the intelligence agencies and the DOD. (Jive powers the DOD milBook application, which is part of the defense-wide collaboration application, milSuite.)

4.3.3 Social Monitoring Providers

While both Jive and IBM are working toward having a social monitoring solution, the team also looked for a company that currently has a core competency in this area.

The idea of mining social media data is a fairly mature concept being used by virtually every large commercial brand today. The technology is based on powerful semantic analysis that can determine shifts in sentiment or key-word themes in real time. Because of the difficulty in interpreting human language in context, most of these programs are only about 80 percent accurate. However, they are still useful for detecting over-arching trends, such as a swing from a positive to negative sentiment or an outbreak of negative reviews. More accurate analysis still requires a human review of language context, which can be very time-consuming and expensive.

Most companies are circumspect about their use of social monitoring, as it is considered a competitive advantage. Here are several anecdotal examples of how social monitoring is being used:

- A company can see sentiment trends to determine how a new product launch is being received in a regional pilot program.

- A brand manager monitors social conversations to detect shifts in sentiments and key words that could indicate a new trend like white jeans or energy water.

- Planners use demand sensing algorithms to immediately identify upward and downward demand shifts based on the conversations taking place.

One organization of note that is talking about its use of social monitoring is the American Red Cross. The organization's Digital Operation Center uses social monitoring to help find emergency victims and pass that information along to first responders (Ungerleider, 2012). The Red Cross also monitors sentiment in times of crisis to quickly adjust operations based on the need for, or response to, critical support services.

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Similar to the findings on the collaboration side of social platforms, the team found no documented applications of social monitoring tools in a manufacturing supply chain.

In terms of software providers, social monitoring is also an extremely crowded space with a constant churn of new entrants. Established experts again provided advice on where to find the industry leaders.

One name that kept surfacing frequently was Sysomos, which was acquired by MarketWired in 2012. After vetting the company's product, the team decided to include it in a live presentation to AFRL in July 2013.

4.3.4 Demonstrating the Solutions

The six scenarios mentioned earlier were provided to three solution providers – IBM, Jive and Sysomos. All three were asked to select several scenarios and then demonstrate how their solution might address those scenarios.

Jive and IBM focused largely on Scenario #1 – Quickly Resolve a Production Problem. They demonstrated how their solutions could help participants reduce the time and cost to solve problems by facilitating the following:

- Quickly finding the right people to help;

- Quickly finding relevant knowledge documentation; and

- Overcoming time zone and language barriers.

In both cases, their solutions helped participants quickly find the most relevant people and knowledge through defined and inferred linkages. This approach is considerably more efficient than today's practice of using phone, fax or email to find the right people or search through silos of information to find the right data. These scenario demonstrations were validated by the real-life results of Teva Pharmaceuticals, which is explained later in this section.

Sysomos demonstrated its solution, Heartbeat, showing how huge sets of social media data across millions of sources could be analyzed. Combining social network analysis along with news and blog feeds could help address Scenario #6 – Potential Raw Material Shortage – by providing an early warning based on information context.

4.3.5 Tony Martins and the Teva Story

One of the prominent names encountered throughout the secondary research effort was Tony Martins. Mr. Peters conducted a preliminary interview with Mr. Martins, and Mr. Schaefer visited his Montreal office in July 2013. This was by far the most encouraging success story found in the supply chain field.

An engineer by training, Mr. Martins' journey at Teva Pharmaceuticals began in 2005 when he discovered 500 batches of incoming material stuck in the pharmaceutical manufacturer's supply chain because operators could not solve anomalies discovered through an incoming product inspection. The batches were just pushed aside because the people who could solve the problem were too far away, both geographically and organizationally.

Mr. Martins studied the problem and realized that two-thirds of the waste among knowledge workers came from trying to find both the information and people who could help resolve

unexpected issues. He calculated that the average time to solve unexpected problems at Teva was four months.

Mr. Martins started doing experiments to allow the operators to expose their problems by posting them on an internal SharePoint site. A live meeting was still required to solve the issues, but even with this rudimentary system, simply exposing the chronic issues created enormous value in terms of productivity, lower working capital and employee morale. Soon, he institutionalized a more robust enterprise social network (Yammer) to provide:

1. Immediate reporting and visibility of problems;

2. Ability to absorb the problem so it did not chronically hurt the whole organization; and

3. A forum to enable quick reaction.

Eventually, his management team became so adept at solving problems quickly that live meetings were no longer required. This was part of a "now" culture that is necessary for quick response to the problems exposed by the ESN.

Mr. Martins implemented systems to solve day-to-day communications problems in addition to the production exceptions. He also pushed through significant new organizational changes based on naturally occurring problem-solving employee "hives." He expanded the network to include outside suppliers and developed advanced organizational thinking to scale his initiative across multiple plant locations when his company was acquired.

Significant accomplishments included the following:

- Raised service level (fulfillment) from 80 percent to 95 percent;

- Reduced manufacturing cycle time by more than 30 percent in six months; and

- Implemented a new SAP enterprise resource planning (ERP) system without any meetings after the first kick-off week. Although there were no specific cost-saving calculations available, implementing an ERP system without live meetings is an extraordinary achievement.

Another idea Mr. Martins proposed was, "Could we create models to actually predict where interactions should be occurring, and then use the software to map where they are actually occurring?" This could expose personality and political hurdles, as well as best practices of the people who are making this work in the very best way.

Mr. Martins' experiences connected the theory, technology and the human dynamics needed to successfully apply ESNs to a complex manufacturing supply chain.

5.0 CONCLUSIONS

After conducting both secondary and primary research into the use of enterprise social network platforms to help improve supply chain communications and coordination, the team has come to the following conclusions.

5.1 Awareness is Growing Rapidly

While the earliest article found on the subject was published on August 10, 2011, the volume of discussions has grown tremendously in just the past year. In addition to the ever-increasing number of articles, there are now five LinkedIn groups and numerous mentions in many other online postings. The use of social technologies in supply chains is also becoming a more frequent topic at conferences for leading organizations, such as the Council of Supply Chain Management Professionals and the Institute for Supply Management.

5.2 The Value is Becoming Evident

The value of these solutions is not yet widely realized. However, organizations like Teva Pharmaceutical are proving quantitative evidence of the value of using social technologies in supply chains. Companies, such as Industrial Mold & Machine in Ohio, are demonstrating the quantitative value of these tools within an organization, overcoming challenges that are also common to supply chains. Comprehensive studies by groups like the McKinsey Global Initiative are providing the groundwork for metrics that can be used to justify at least the pilot projects that will demonstrate quantitative results on a larger scale. Such evidence will be instrumental to widespread adoption of the solutions.

5.3 Experience is Key to Understanding Benefits

One of the recurring themes in both the secondary and primary research was that companies often did not know exactly what to do or even what benefit they would realize until they tried implementing a social technology solution. One reason for this is that the technology itself is new. However, the primary reason seems to be that the greatest benefits come from adapting or changing practices along with the new technology. Without a roadmap, some of those things cannot be learned without experience.

5.4 Recommendations

Just as the e-commerce pioneers could not understand and codify the benefits until they experimented with the solutions, the same holds true for the use of social technologies in supply chains. By monitoring and measuring a well-defined experiment, the potential value of these solutions can be better understood and quantified. That, in turn, would help the Air Force accelerate adoption of these solutions to benefit its own supply chains.

The team recommends two pilots to help advance the understanding and implementation of social technologies.

5.4.1 Pilot #1 – Resolving Supply Chain Production Problems

Based on the findings and where the earliest successes were realized, the team recommends a pilot program be developed to focus on more quickly resolving supply chain production problems. These challenges are unexpected, often have significant time pressures and typically involve high volumes of unstructured communications. These communications move very fast,

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are isolated in silos, such as email or person-to-person conversations, and usually are not retained and cannot be leveraged to help guard against or resolve future reoccurrences.

The ideal pilot would have characteristics similar to Scenario #1 – Quickly Resolve a Production Problem, which was developed during the primary research phase (See APPENDIX for more details). Rather than tackling an entire weapon system, the Air Force should target a component that would be more manageable for a pilot. Since participation would be required by all tiers, the supply chain should not be too complex.

A key area to focus on in this pilot is adoption, which is defined as "the decision to make full use of an innovation" (Rogers, Diffusion of Innovations, 2003). Understanding how adoption occurs (or does not occur) in this pilot will help create a roadmap to accelerate future adoption.

Properly conducting this pilot would take approximately one year, although many of the insights will be gained early in the process. As this project will require regular access to the participants, the pilot supply chain participants ideally should not be too geographically dispersed.

There will be some effort required by the participants, which also should be factored into the pilot selection. Choosing participants with management teams that grasp the concepts and have an interest in learning through this process will help deliver more meaningful insights.

At the end of such a pilot, the Air Force will have a solid understanding of how to leverage these solutions to improve supply chain performance. Some of the detailed outcome information would include the following:

- Quantify the effort and costs required.
  - Solution implementation;
  - Onboarding; and
  - Driving adoption.
- Quantify the benefit of such an effort.
  - Reduction in labor time and costs;
  - Reduction in production lead times;
  - Reduction in order fulfillment cycle time;
  - Increase in delivery performance; and
  - Increase in product quality.
- Identify the ideal program characteristics to help target future efforts.

The lessons learned from this pilot could help overcome some of the most time-consuming and costly DOD supply chain challenges. In addition, these solutions provide the exact capabilities needed to better foster collaborative supply chain innovation – opening up opportunities for even greater value.

5.4.2   Pilot #2 – Improved Visibility into the Industrial Base

The team recommends development of a pilot that will use social monitoring and the overall ESN platform to provide visibility into the health and activities of the industrial base. Many of the current industrial base efforts, such as the sector-by-sector, tier-by-tier studies, are snapshots

that begin aging once the study is complete. Such studies are also typically limited to rigid data sets and are viewed with disdain by the industrial base due to the effort required to complete the questionnaires.

By contrast, the use of social technologies can provide immediate industrial base insights around the clock while imposing no additional burden on the industrial base. Potential insights could range from identifying a lower-tier supplier that may be having production issues to uncovering a potential raw material shortage.

Such a pilot would have characteristics similar to Scenario #5 – Lack of Lower Tier Visibility – and Scenario #6 – Potential Raw Material Shortage (See APPENDIX for more details). Unlike Pilot #1, AFRL would likely benefit from taking a wider perspective and looking across several complex supply chains, such as the F-35. This larger sampling could provide lessons that may not be learned if the pilot is done on a smaller scale.

Much of the cost and effort for such a pilot will be in the upfront determination of the desired results, what to monitor and the configuration of the solution. Once those things are in place, the team will be able to experiment with different information sources and algorithms to determine what is possible and valuable.

At the end of such a pilot, the Air Force will have a solid understanding of how to leverage these solutions to improve visibility into supply chains and the industrial base. Some of the detailed outcome information would include the following:

- Quantify the effort and costs required.
  - Solution implementation; and
  - Driving adoption.
- Quantify the benefit of such an effort.
  - Reduction in risk;
  - Increase in U.S. industrial base visibility; and
  - Increase in supply chain agility.
- Identify the ideal program characteristics to help target future efforts.

The lessons learned from this pilot could help provide meaningful industrial base and supply chain insights that are not easily attained today. In addition to providing leaders with better information on which to base policy decisions, these insights can help defense operations reduce risks while providing greater agility.

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APPENDIX A

AFRL/SC/SM Project Scenario Structure v1.4

A1.0 Introduction

A key objective of the project was to benchmark how commercial organizations are using social media platforms to help overcome supply chain communications and coordination challenges. While there is considerable literature and there are many discussions on the subject, there are very few real-world examples.

In the absence of existing case studies to identify best practices, the team developed several demonstration scenarios. These scenarios were provided to several social platform solutions providers, so that they can demonstrate how their solutions might help solve common DOD supply chain challenges. The objectives of this effort are to:

- Demonstrate the potential value of Enterprise Social Network platforms;
- Identify adoption hurdles; and
- Build the foundation for a business case.

A2.0 Approach

The team identified a number of different potential supply chain scenarios found in the DOD. After reviewing the different ideas, they all fell into one of the following three buckets:

1. Reactive resolution (e.g., Find someone else who has experienced a similar problem and can help resolve the problem);
2. Proactive collaboration (e.g., Engage the supply chain in design, planning and improvement); and
3. Early warning (e.g., Identify potential production or supplier problems at early stages).

The team also identified common challenges to collaborating and coordinating quickly and efficiently.

1. Find relevant knowledge
2. Find the right people or organizations
3. Collaborate around a document
4. Maintain version control
5. Minimize knowledge worker time and cost
6. Increase response times
7. Maintain privacy
8. Get early warnings of problems
9. Improve supply chain visibility
10. Overcome time zone and language barriers

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As these scenarios begin to lay the foundation for potential business cases, they are tied to metrics defined in the Supply Chain Operations Reference Model. This approach helps the team better draw conclusions from these and other supply chain scenarios.

Relevant Supply Chain Metrics

Supply Chain Reliability

RL.1.1   Perfect Order Fulfillment

RL.2.1   Percentage of Orders Delivered In Full

RL.2.2   Delivery Performance to Customer Commit Date

Supply Chain Responsiveness

RS.1.1   Order Fulfillment Cycle Time

RS.2.1   Source Cycle Time

RS.2.2   Make Cycle Time

Supply Chain Agility

AG.1.1   Upside Supply Chain Flexibility

AG.1.2   Upside Supply Chain Adaptability

AG.1.3   Downside Supply Chain Adaptability

Supply Chain Costs

CO.1.1   Supply Chain Management Cost

CO.2.1   Cost to Plan

CO.2.2   Cost to Source

CO.2.3   Cost to Make

Supporting Collaboration and Coordination Metrics

1. Knowledge search time
2. Team assembly time
3. Team collaboration/coordination time
4. Issue resolution time
5. Team satisfaction
6. Customer satisfaction

A standard structure for the scenarios was developed for greater consistency, which helps with the analysis. Each scenario has a description of the problem, a listing of the common challenges encountered and key supply chain metrics used to measure solution results. The team avoided providing too much direction to allow each responder greater flexibility in how they apply their solution.

The supply chain metrics follow the SCOR model, although they can be changed to a different model at any time. The purpose of identifying relevant metrics is to provide a means to easily translate the findings from each scenario into defined supply chain objectives.

The following scenarios were provided to a few of the solutions providers that agreed to work with AFRL on this effort. The providers developed a demonstration, showing how their solution could be used in each of the scenarios.

Scenario #1 – Quickly Resolve a Production Problem
Scenario Category: Reactive Resolution

Description	Challenges
A supply chain consisting of five manufacturers makes product "X." One of the suppliers at a lower tier is having a problem producing their part. The machinist isn't sure if the problem is with the equipment, the specifications or their lack of experience with the material. They need to find someone fast who can help resolve the issue. Sources of assistance inside the supply chain could include other machinists, material specialists, mechanical engineers. The knowledge may be contained in work instructions, specifications, blogs, discussion threads, etc. However, the knowledge and discussions should remain private to just this group. Assume that each node of the supply chain is connected to its customer and one supplier, but the entire supply chain is not yet linked. Assume that some of the manufacturers are overseas and don't speak English.	1. Find the right people/organization 2. Find relevant knowledge 3. Minimize time and cost 4. Overcome time zone and language barriers

Relevant Supply Chain Metrics:
    Supply Chain Reliability
    RL.1.1   Perfect Order Fulfillment
    RL.2.2   Delivery Performance to Customer Commit Date
    RS.1.1   Order Fulfillment Cycle Time

Scenario #2 – Handle a Surge in Demand
Scenario Category: Reactive Resolution

Description	Challenges
A supply chain consisting of five manufacturers makes product "X." The OEM is being asked to increase production immediately by 20% and must respond right away. The OEM must quickly communicate and collaborate with the existing supply chain on capacity and scheduling to ensure they can meet the increased demand. In the course of that communications, they find that their existing supply chain can meet the demand with the exception of additional CNC machining capacity. The OEM must then identify manufacturers with the right CNC machining capability in their other supply chains, find one with available capacity and bring that supplier into the collaboration with the product "X" team. Assume that all of the manufacturers and end-users are already part of an online community for product "X." Also assume that the OEM uses the same platform to connect the supply chains for other products.	1. Find the right people/organization 2. Find relevant knowledge 3. Minimize time and cost

Relevant Supply Chain Metrics:
    Supply Chain Agility
        AG.1.1   Upside Supply Chain Flexibility
        AG.1.2   Upside Supply Chain Adaptability

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Scenario #3 – Improve Engineering Change Order Collaboration	
Scenario Category: Proactive collaboration	
Description	**Challenges**
A large manufacturer needs to make changes to a product design for weapons system "Y." Before they do, they want to check with their supply chain of five manufacturers to identify the optimum change that will have the lowest impact on cost and time. They also want to engage the end-user community to ensure the changes won't impact performance. This effort will require finding the right people at each of the five manufacturers and collaborating around a specification document and 3-D model. The collaboration needs to remain private to just those in the weapons system "Y" supply chain, and the discussion thread needs to be archived. Assume that all of the manufacturers and end-users are already part of an online community for weapons system "Y."	1. Find relevant knowledge 2. Collaborate around a document 3. Maintain privacy 4. Minimize time and cost

Relevant Supply Chain Metrics:
  Supply Chain Reliability
  RL.1.1   Perfect Order Fulfillment
  RL.2.1   % Orders Delivered In Full
  RL.2.2   Delivery Performance to Customer Commit Date
  Supply Chain Responsiveness
  RS.1.1   Order Fulfillment Cycle Time
  RS.2.1   Source Cycle Time
  RS.2.2   Make Cycle Time

Scenario #4 – Crowd-source a New Product	
Scenario Category: Proactive collaboration	
Description	**Challenges**
There is chatter within the Warfighter community about the need for a new device to speed the change of engine oil, reducing man-hours and restoring equipment to operations faster. A Captain at the Pentagon responsible for sustainment picks up on the chatter through an analysis tool. He identifies those in the field with the greatest knowledge and invites them to join a group to develop new product "G." The Captain also invites the program manager, a buyer, the engineering service authority and five suppliers to the group. This effort will require using a social platform solution to first raise awareness of the issue and then identify the Warfighters that will likely make the greatest contributions. In addition to facilitating group collaboration, the solution should allow for polling of a larger Warfighter community on features and functions—presenting those results graphically. Throughout this process, the solution should capture intellectual property. Assume that all of the participants are already part of a broad online military community.	1. Find relevant knowledge 2. Collaborate around a document 3. Maintain privacy 4. Minimize time and cost

Relevant Supply Chain Metrics:
    Supply Chain Responsiveness
    RS.1.1   Order Fulfillment Cycle Time
    RS.2.1   Source Cycle Time
    RS.2.2   Make Cycle Time

Scenario #5 – Lack of Lower Tier Visibility

Scenario Category: Early Warning

Description	Challenges
A manufacturing supplier network is producing product "Z," and the lower tier suppliers are having a problem meeting specifications. While it hasn't yet impacted delivery dates, it will if left unchecked. The problem is being discussed extensively at the lower tiers, but that information isn't being passed on up the supply chain. The OEM has no visibility into this issue, yet it will impact the entire supply chain. The OEM would like to identify potential problems while there is still time to help resolve the issues before production schedules are impacted. Since there are many suppliers in this network and there is considerable chatter, the OEM could not manually monitor all of the conversations. They would like a solution that monitors and analyzes chatter and could provide an early warning of potential problems. Assume that the supply chain participants are actively using a social platform to collaborate and coordinate.	1. Get early warnings of problems 2. Improve supply chain visibility 3. Find relevant knowledge 4. Find right people/organizations

Relevant Supply Chain Metrics:
    Supply Chain Reliability
    RL.1.1   Perfect Order Fulfillment
    RL.2.1   % Orders Delivered In Full
    RL.2.2   Delivery Performance to Customer Commit Date

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Scenario #6 – Potential Raw Material Shortage	
Scenario Category: Early Warning	
Description	**Challenges**
A manufacturing supplier network is producing product "Z," and the raw material used is somewhat constrained. The OEM needs to keep an eye out for early warning signs of any potential shortage. Indicators could range from a pending strike to rapidly increasing prices to changing delivery dates in the supply chain. Sources for those indicators could include chatter on public social media, commodities exchange pricing, news stories and associated public comments as well as chatter on the social platform used by the supply chain. The OEM would like a solution that monitors and analyzes multiple sources and could provide an early warning of a potential problem. Assume that the supply chain participants are actively using a social platform to collaborate and coordinate.	1. Get early warnings of problems 2. Find relevant knowledge 3. Find right people/organizations

Relevant Supply Chain Metrics:
  RL.1.1   Perfect Order Fulfillment
  RL.2.1   % Orders Delivered In Full
  RL.2.2   Delivery Performance to Customer Commit Date

LIST OF SYMBOLS, ABBREVIATIONS, AND ACRONYMS

AFRL	Air Force Research Laboratory
CR&D III	Collaborative Research and Development III
DARPA	Defense Advanced Research Projects Agency
DOD	Department of Defense
DTIC	Defense Technical Information Center
EAR	Export Administration Regulation
EDI	Electronic Data Interchange
ERP	Enterprise Resource Planning
ESN	Enterprise Social Network
ITAR	International Traffic in Arms Regulation
MATES II	Manufacturing Technology Support II
RX	Materials and Manufacturing Directorate
RXO	Integration & Operations Division
RXOB	Business Operations Branch
S2T2	Sector-by-sector, Tier-by-tier
SCOR®	Supply Chain Operations Reference
USAF	United States Air Force
WPAFB	Wright-Patterson Air Force Base